DCR BMP Reference Materials for Spreadsheet Methodology – August 26, 2008

BMP Pollutant Removal Efficiencies

Practice Number	Practice	Removal of Total Phosphorus by Runoff Volume Reduction (RR, as %) (based upon 1 inch of rainfall --90% storm)	Removal of Total Phosphorus by Treatment -- Pollutant Concentration Reduction (PR, as %)	Total Removal of Total Phosphorus (TR, as %)
1.1	Green Roof 1	45	0	45
1.2	Green Roof 2	60	0	60
2.1	Rooftop Disconnection 1	25	0	25
2.2	Rooftop Disconnection 2	50	0	50
3.1	Rain Tanks/Cisterns 1	actual volume x .75	0	actual volume x .75
4.1	Soil Amendments 1	50	0	50
4.2	Soil Amendments 2	75	0	75
5.1	Permeable Pavement 1	45	25	59
5.2	Permeable Pavement 2	75	25	81
6.1	Grass Channel 1	10	15	23
6.2	Grass Channel 2	20	15	32
7.1	Bioretention 1	40	25	55
7.2	Bioretention 2	80	50	90
8.1	Infiltration 1	50	25	63
8.2	Infiltration 2	90	25	93
9.1	Dry Swale 1	40	20	52
9.2	Dry Swale 2	60	40	76
10.1	Wet Swale 1	0	20	20
10.2	Wet Swale 2	0	40	40
11.1	Sheet Flow to Conserved Open Space 1	0	50	50
11.2	Sheet Flow to Conserved Open Space 2	0	75	75
12.1	Extended Detention Pond 1	0	15	15
12.2	Extended Detention Pond 2	15	15	28
13.1	Filtering Practice 1	0	60	60
13.2	Filtering Practice 2	0	65	65
14.1	Constructed Wetland 1	0	50	50
14.2	Constructed Wetland 2	0	75	75
15.1	Wet Pond 1	0	50	50
15.2	Wet Pond 2	0	75	75

Table 2 Green Roof Design Guidance	
Level 1 Design (RR: 45 TP: 0)	**Level 2 Design (RR: 60 TP: 0)**
Depth of media four to six inches	Media depth greater than six inches
Soil media not tested for P-index	Soil media with P index less than 10
Green roof receives roof runoff	Green roof does not receive roof runoff or is designed with additional media depth
Sizing: Level 1: 0% of CDA **Level 2:** 10% of CDA	

Table 3 Simple Rooftop Disconnection
RR: 50% for A and B Soils **RR: 25%** for C and D Soils **PR: O**
Only allowed for residential lots greater than 6000 square feet
Rooftop area draining to any single discharge point should not exceed 1000 sf and drain continuously through pervious filter until reaching property line ort drainage swale
Slope should be in 1 to 2% range and not cause basement seepage

Table 4 Rain Tanks and Cisterns
RR 15% for seasonal irrigation reuse and **RR 65%** for internal dual use **PR= 0**
Assume tanks consume 5% of building area.

Table 5 Soil Amendments
RR: 75% for rooftop disconnection **RR: Shift to forest Rv** if combined with reforestation **RR**: Go to Level 2 if RR added to grass or dry swale
Amended soils to a foot depth; should be sized at 50% of CDAa

Table 6 Permeable Pavement Design Guidance	
Level 1 Design (RR: 45 TP: 25)	**Level 2 Design (RR: 75 TP: 25)**
TV= (Rv)(A) (1")/12	TV = 1.1(Rv) (A) (1")/12
Soil Infiltration less than one-inch/hr	Soil infiltration rate exceeds one-inch/hr
Underdrain needed	Underdrain not required
Accepts runoff from non-pervious pavement	CDA = The pervious paver area
Slopes from 2 to 5%	Slopes less than 2%
Sizing: Level 1: 0% of CDA **Level 2:** 0% of CDA	

Table 7 Bioretention Design Guidelines	
Level 1 Design (RR 40 TP: 25)	**Level 2 Design (RR: 80 TP: 50)**
TV= (Rv)(A)(1")/12	TV= 1.25 (Rv)(A) (1")/12
Filter media at least 24" deep	Filter media at least 36" deep
One form of accepted pretreatment	Two or more forms of accepted pretreatment
At least 75% plant cover	At least 90% plant cover, including trees.

One cell design	Two cell design
Underdrain	Infiltration design or underground stone sump
Both designs include media that is tested to have soil P index less than 10	
Sizing: Level 1: 5% of CDA **Level 2:** 10% of CDA.	

Table 8 Infiltration Design Guidelines	
Level 1 Design (RR: 50 TP: 25)	**Level 2 Design (RR: 90 TP: 25)**
TV= (Rv)(A) (1")/12	TV= 1.1(Rv)(A) (1")/12
CDA includes pervious area	CDA nearly 100% impervious
At least one form of pretreatment	At least two forms of pretreatment
Soil infiltration rate of 0.5 to 1.0 in/hr	Soil infiltration rates of 1.0 to 4.0 in/hr
Underdrain utilized	No underdrain needed
Sizing: Level 1: 3% of CDA **Level 2:** 5% of CDA.	

Table 9 Dry Swale Design Guidance	
Level 1 Design (RR: 40 TP: 20)	**Level 2 Design (RR: 60 TP: 40)**
TV= (Rv)(A) (1")/12	TV= 1.1 (Rv)(A) (1")/12
Swale slopes from <0.5% or >2.0%	Swale slopes from 0.5% to 2.0%
Soil infiltration rates less than 0.5 in	Soil infiltration rates exceed one inch
Swale served by underdrain	Lacks underdrain or uses underground stone sump
On-line design	Off-line or multiple treatment cells
Media depth less than 18 inches	Media depth more than 24 inches
Sizing: Level 1: 7% of CDA **Level 2:** 10% of CDA	

Table 10 Wet Swale Design Guidance	
Level 1 Design (RR: 10 TP: 20)	**Level 2 Design (RR: 0 TP: 40)**
TV= (Rv)(A) (1")/12	TV= 1.25 (Rv)(A) (1")/12
Swale slopes more than 1%	Swale slopes less than 1%
On-line design	Off-line swale cells
No planting	Wetland planting within swale cells
Note: Generally recommended only for flat coastal plain conditions with high water table. Linear wetland always preferred to wet swales	
Sizing: Level 1: 7% of CDA **Level 2:** 10% of CDA	

Table 11 Sheetflow to Conserved Open Space
RR: 75% for A and B Soils **RR: 50%** for C and D Soils **PR: O**
Conservation Area must be at least 0.5 acres in size and protected by easement
Maximum contributing sheet flow path from adjacent pervious areas is 150 feet
Maximum contributing sheet flow path from adjacent impervious areas is 75 feet
Slopes cannot be steeper than 3%

Table 12 Extended Detention (ED) Pond Guidance	
Level 1 Design (RR: 0 TP: 15)	**Level 2 Design (RR: 15 TP: 15)**
TV= (Rv)(A) (1")/12	TV = 1.25(Rv) (A) (1")/12
At least 15% of TV in permanent pool	More than 40% of TV in deep pool or wetlands
Flow path at least 1:1	Flow path at least 1:5 to 1
Average ED time of 24 hours or less	Average ED time of 36 hours
No maximum vertical ED limit	Maximum vertical ED limit of 4 feet
Turf Cover on Floor	Trees and wetlands in the planting plan
Single cell (i.e., no forebay and micropool)	Multiple cells or treatment methods (e.g., sand filter or biotretention on pond floor)
Sizing: Level 1: 2% of CDA **Level 2:** 4% of CDA	

Table 13 Filtering BMP Design Guidance	
Level 1 Design (RR: 0 TP: 60)	**Level 2 Design (RR: 0 TP 65)**
TV= (Rv)(A) (1")/12	TV= 1.25 (Rv)(A) (1")/12
One cell design	Two cell design
Sand media	Sand media w/ organic layer
CDA includes pervious area	CDA nearly 100% impervious
Sizing: Level 1: 3% of CDA **Level 2:** 5% of CDA	

Table 14 Constructed Wetland Design Guidance	
Level 1 Design (RR: 0 TP: 50)	**Level 2 Design (RR: 0 TP:75)**
TV= (Rv)(A) (1")/12	TV = 1.5(Rv) (A) (1")/12
Single cell (with forebay)	Multiple cells
ED wetland	No ED in wetland
Uniform wetland depth	Diverse microtopography
Flow path 1:1 or less	Flow path 1.5:1 or more
Emergent wetland design	Wooded wetland design
Sizing: Level 1: 3% of CDA **Level 2:** 5% of CDA	

Table 15 Wet Pond Design Guidance	
Level 1 Design (RR: 0 TP: 50)	**Level 2 Design (RR: 0 TP: 75)**
TV= (Rv)(A) (1")/12	TV = 1.5(Rv) (A) (1")/12
Single Pond Cell, with Forebay	Wet ED or Multiple Cell Design
Pool Depth Range of 3 to 12 feet	Pool Depth Range of 4 to 8 feet
Flow path 1:1 or less	Flow path 1.5:1 or more
Pond intersects with groundwater	Adequate Water Balance
Sizing: Level 1: 3% of CDA **Level 2:** 5% of CDA	